DENGUE AND CHIKUNGUNYA: SEROEPIDEMIOLOGY IN PRIMARY CARE USERS**DENGUE E CHIKUNGUNYA: SOROEPIDEMIOLOGIA EM USUÁRIOS DA ATENÇÃO BÁSICA****DENGUE Y CHIKUNGUNYA: SOROEPIDEMIOLOGÍA EN USUARIOS DE LA ATENCIÓN BÁSICA**

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ABSTRACT

Objective: to characterize the epidemiological profile of arboviruses dengue and Chikungunya. **Method:** this is an epidemiological, descriptive, retrospective, quantitative study. A total of one thousand patient records were selected from patients with dengue-positive IgM seropositivity and were randomly selected from the serological results of the year 2016. Sociodemographic information was collected from the patients, and the results are presented in the form of figures. **Results:** it is revealed that, of the thousand records chosen at random from both arboviruses, the female was the most affected; the age group with the highest number of cases was between 21 and 40 years old, and the smallest age group was older than 60 years; the ethnic group and the urban area were the ones that presented the most cases of dengue and Chikungunya, and in relation to the notification, only a little more than half of the cases were reported. **Conclusion:** an endemic profile of arbovirus infection that deserves attention and effort by managers, professionals and society, for the proper control and monitoring of arboviruses in Brazil, was pointed out by the study. It is important to emphasize the need for Primary Health Care services to have a high level of epidemiological surveillance, especially when reporting and investigating arboviruses in an adequate manner. **Descriptors:** Arbovirus infections; Epidemiology; Chikungunya; Dengue; Primary Health Care; Public health.

RESUMO

Objetivo: caracterizar o perfil epidemiológico das arboviroses dengue e Chikungunya. **Método:** trata-se de um estudo epidemiológico, descritivo, retrospectivo, quantitativo. Escolheu-se um total de mil prontuários de pacientes com sorologia IgM positiva para dengue e Chikungunya de forma aleatória entre os resultados sorológicos ocorridos no ano de 2016. Coletaram-se as informações sociodemográficas dos pacientes, e os resultados se apresentam em forma de figuras. **Resultados:** revela-se que, dos mil prontuários escolhidos aleatoriamente de ambas as arboviroses, o sexo feminino foi o mais acometido; a faixa etária com maior número de casos foi de 21 a 40 anos e a com menor número foi em maiores de 60 anos; a etnia parda e a zona urbana foram as que mais apresentaram casos de dengue e Chikungunya e, em relação à notificação, somente um pouco mais da metade dos casos foi notificado. **Conclusão:** apontou-se, pelo estudo, um perfil endêmico de infecção por arboviroses que merece atenção e esforço dos gestores, profissionais e da sociedade, para o devido controle e monitoramento das arboviroses no Brasil. Ressalta-se a necessidade de os serviços de Atenção Primária à Saúde terem resolutividade quanto à vigilância epidemiológica, principalmente na notificação e investigação das arboviroses de forma adequada. **Descritores:** Infecções por Arbovírus; Epidemiologia; Chikungunya; Dengue; Atenção Primária à Saúde; Saúde Pública.

RESUMEN

Objetivo: caracterizar el perfil epidemiológico de las arbovirosis dengue y chikungunya. **Método:** se trata de un estudio epidemiológico, descriptivo, retrospectivo, cuantitativo. Se eligió un total de mil prontuarios de pacientes con serología IgM positiva para dengue y chikungunya de forma aleatoria entre los resultados serológicos ocurridos en el año 2016. Se recogen las informaciones sociodemográficas de los pacientes y los resultados se presentan en forma de figuras. **Resultados:** se revela que, de los mil prontuarios elegidos aleatoriamente de ambas arbovirosis, el sexo femenino fue el más acometido; el grupo de edad con mayor número de casos fue de 21 a 40 años y la con menor número fue en mayores de 60 años; la etnia parda y la zona urbana fueron las que más presentaron casos de dengue y chikungunya y, en relación a la notificación, sólo un poco más de la mitad de los casos fue notificado. **Conclusión:** se apuntó, por el estudio, un perfil endémico de infección por arbovirosis que merece atención y esfuerzo de los gestores, profesionales y de la sociedad, para el debido control y monitoreo de las arbovirosis en Brasil. Se resalta la necesidad de que los servicios de Atención Primaria a la Salud tengan resolución en cuanto a la vigilancia epidemiológica, principalmente en la notificación e investigación de las arbovirosis de forma adecuada. **Descriptor:** Infecciones por Arbovirus; Epidemiología; Chikungunya; Dengue; Atención Primaria a la Salud; Salud Pública.

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INTRODUCTION

It is known that arboviruses are diseases transmitted by arthropods to humans and other animals, due to the female bite of hematophagous mosquitoes, mainly of the genus *Aedes*. It is explained that arboviruses causing disease in humans and other warm-blooded animals are members of five viral families: Bunyaviridae, Togaviridae, Flaviviridae, Reoviridae and Rhabdoviridae. It is estimated that there are more than 545 species of arbovirus among which more than 150 species are related to infectious diseases in humans and domestic animals. The arboviruses are maintained in the transmission cycle between arthropods and vertebrate reservoirs as the main host amplifiers.¹

It can be seen that countries with susceptible populations and permeable borders with large numbers of migrants and visitors from epidemic areas and efficient vectors (*Aedes aegypti* and *Aedes albopictus*) are favorable scenarios for the dissemination of arboviruses. It is currently an important public health problem in several localities of the planet because they are rapidly expanding diseases due to the spread of the vector mosquito and also the possibility of causing extensive epidemics. Consequently, a large number of people are affected, which may have an impact on morbidity and mortality, and are aggravated by the absence of specific treatment, vaccines and effective prevention and control measures.²⁻⁴

In Brazil, among the arboviruses with the greatest circulation are dengue (DENV) and Chikungunya (CHIKV), and in the country the first cases of arbovirus infections date back to the end of the 19th century, with cases of DENV in Rio de Janeiro (RJ) and Curitiba (PR). It is pointed out that the DENV virus, for over 40 years, was the predominant, with periodic outbreaks. The first cases of CHIKV virus infection were registered in Oiapoque (PA) and Feira de Santana (BA) in 2014 and since then, there has been a rapid spread of these viruses to other Brazilian regions.²⁻⁶

It is clear that DENV is the arbovirose that has the greatest expansion of the number of cases in the world, estimated around 50 million cases per year and approximately 2.5 billion people living in endemic areas. All four serotypes existing in Brazil are circulating, being distributed in practically all the national territory. There were 1,688,688 probable cases of dengue in 2015; in 2016, up to the 49th epidemiological week, there were 1,487,924 probable cases of dengue in the country, with an incidence of 727.6 cases/100

thousand inhabitants) and in 2017, in Brazil, 251,711 probable cases of dengue and 30 deaths.^{4,7-8}

The simultaneous circulation of the four serotypes of the DENV is favored by geographic, climatic and socioeconomic characteristics in the State of Maranhão, and serotype 4 was introduced at the end of 2011. *A. aegypti*, the main vector involved in the transmission of the dengue virus in the State of Maranhão in 1969, with the São Luís capital as the route of entry. However, it is reported that the problem only caught the attention of health agencies in 1995, when the first cases of classical dengue in the district of COHAB - Anil, with a total of 1,776 notifications, making possible the first epidemic in São Luís, in 1996, with 4,641 reported cases. In that year, a seroepidemiological survey was conducted in the region, and it was estimated that 41.40% of the studied population were infected by DENV-1.^{7,9}

It was recently brought about by the introduction of CHIKV in the Brazilian territory, of great concern due to its rapid dissemination. A total of 38,332 cases were reported in 2015. In 2016, 277,882 cases of CHIKV fever were reported in Brazil, while in 1857, 185,854 cases were reported. Among the regions with the highest number of reported cases of CHIKV fever, the Northeast in 2015 and 2016, and the State of Maranhão registered in 2016, 12,906 cases, with five deaths, in 2017, there were 8,405 confirmed cases and one death.⁷⁻⁸

In the State of Maranhão, due to the presence of a warm and humid tropical climate, the mosquito *A. aegypti* proliferates, with mosquito infestation occurring in at least 73.3% of the municipalities. A total of 21,059 cases of dengue fever were reported in Maranhão by the Ministry of Health in 2016, of which 5,351 were confirmed, of which 2,351 occurred in São Luís. There were 5,243 cases reported in Chikungunya fever cases, 214 of which were confirmed in the laboratory and 1,763 confirmed by clinical and epidemiological criteria.⁹⁻¹⁰

The clinical manifestations of these arboviruses in human beings vary from undifferentiated, moderate or severe febrile disease, rashes and arthralgias, to neurological syndrome and hemorrhagic syndrome. In endemic regions, the clinical symptoms of these arboviruses can be confounded with those caused by other acute viral diseases, such as yellow fever and malaria, which hinders their diagnosis and clinical management. Intensification, due to the specific absence of treatment, vaccines

and effective measures of prevention and control, morbidity and mortality of these arboviruses.¹⁻²

DENV and CHIKV arboviruses are reported to be notifiable diseases and are present in the National List of Compulsory Notification of Diseases, Injuries and Events of Public Health, and it is known that the occurrence of suspected cases may indicate a possible outbreak, therefore, the nearest public health authorities shall be notified immediately. A compulsory notification is the official communication to the health authorities about the occurrence of a disease or health problem by any health professional or citizen, for the purpose of adopting pertinent intervention measures. Through its effective use, it is possible to perform a dynamic diagnosis of the occurrence of an event in the population, and may provide subsidies for causal explanations of the aggravations of compulsory notification, in addition to indicating risks to which people are subject, thus contributing to the identification of the epidemiological reality of a given geographical area.¹¹

The Brazilian scenario facilitates the possibility of large epidemics, since it is constituted by a large terrestrial extension and most of the country has a tropical climate, being a suitable place for the existence of the vector and, therefore, for the occurrence of these arboviruses. The following contributing factors are: the remarkable adaptability of these viruses and the possibility of emerging and establishing themselves in new geographical areas; the modification of the environment by anthropic actions; disordered urban growth; climate change; the susceptibility of the human population; deforestation; population migration; the disordered occupation of urban areas and the precarious health conditions that favor viral amplification and transmission.^{1-2,12-3}

It is verified that the magnitude of the distribution of arbovirus outbreaks in Brazil and the high socioeconomic costs are extremely difficult to be measured and can be considered as unknown. In this sense, it is urgent to elaborate researches in order to seek more knowledge about the epidemiology of these arboviruses, especially in endemic regions, such as the State of Maranhão, as a way to contribute to new discoveries regarding the new approaches to diagnosis, control and prevention of this infection and measures to face this great challenge.

OBJECTIVE

- To characterize the epidemiological profile of arboviruses dengue and Chikungunya.

METHOD

This is a descriptive, retrospective, quantitative-based epidemiological study, where the data collection was done in the Laboratory Management System (LAG), which is the database of the Central Public Health Laboratory of the State of Maranhão (LACEN - BAD). A total of 1,000 records of patients with dengue positive and dengue positive IgM seropositivity were randomly selected from the serological results of 2016. 500 records of patients with clinical suspicion of dengue fever and 500 cases of CHIKV fever were selected. The sociodemographic information of the patients, such as age, sex, ethnicity, age group, zone, notification and the municipality of origin were also collected.

The data obtained in the Microsoft Excel® software (2016) were tabulated, and subsequently these were analyzed by descriptive statistics using the STATA 11.0 software (Stata Corp. College Station, Texas, USA). The results are presented in tables and graphs.

It is reported that this research is a subproject of a project already approved in the call PPSUS - FAPEMA/MS-DECIT/CNPq/SES/No. 008/2016 entitled "Optimization of a diagnostic method for the detection of arboviral infections in serum of patients seen in basic health units in the state of Maranhão".

This project was submitted to the Research Ethics Committee (REC) of the Ceuma University, in compliance with the requirements of Resolution No. 466/2012 of the National Health Council, and obtained the Consubstantiated Approval Opinion No. 1,570,391 with the next CAAE: 56032816.4.0000.5084.

RESULTS

It was identified the distribution of cases of DENV and CHIKV according to the age of the respondents, that several age groups were affected, with a great variation between them. Dengue infected patients were found between eight months to 87 years of age and, in relation to CHIKV, the lowest identified age was eight days and the highest age was 90 years, revealing that the age group most affected was between 21 and 40 years of age in both arboviruses (Table 1).

Table 1. Distribution of the sociodemographic variables of the cases of dengue and Chikungunya infection of the users attended in Primary Care. Brazil, 2017 (n = 500).

Variable	Dengue n (%)	Chikungunya n (%)
Gender		
Female	326 (65%)	388 (82%)
Male	174 (35%)	112 (18%)
Age group (years)		
0 - 20	125 (25%)	92 (18%)
21 - 40	214 (43%)	196 (39%)
41 - 60	125 (25%)	135 (27%)
> 60	36 (7%)	77 (16%)
Ethnicity		
Brown	193 (39%)	237 (47%)
Yellow	110 (22%)	71 (14%)
White	61 (12%)	38 (8%)
Black	14 (3%)	5 (1%)
Not informed	122 (24%)	149 (30%)
Zone		
Urban	356 (71%)	369 (74%)
Rural	54 (11%)	41 (8%)
Peri-urban	4 (1%)	17 (3%)
Not informed	86 (17%)	73 (15%)
Notification of cases		
Notified Cases	277 (55%)	288 (58%)
Non-notified cases	223 (45%)	212 (42%)

It was found that, in municipalities with confirmed cases of dengue infection in users attending the Basic Health Units (BHU)

inserted in Primary Care (PC) or Primary Health Care (PHC), the municipalities in Table 2.

Table 2. Distribution of the municipalities as the cases of dengue infection of the users attended in Primary Care. Brazil, 2017 (n = 500).

Municipalities	n	%
Balsas	102	20
Caxias	91	18
São Luís	60	12
Santa Inês	33	7
Cidelândia	29	6
Vargem Grande	24	5
São José de Ribamar	21	4
Cururupu	18	4
Paço do Lumiar	18	4
Açailândia	11	2
Nova Olinda do Maranhão	11	2
Imperatriz	8	2
São Francisco do Brejão	8	2
Formosa da Serra Negra	7	1
Bacabeira	6	1
Buriticupu	5	1
Estreito	5	1
Fortuna	5	1
Nina Rodrigues	5	1
Others	33	6

It was presented, in relation to the inhabitants of the municipalities most affected by CHIKV (Table 3).

Table 3. Distribution of municipalities in cases of Chikungunya infection among users served in Primary Care. Maranhão, Brazil, 2017 (n = 500).

Municipalities	n	%
São Luís	169	34
Caxias	161	32
São José de Ribamar	40	8
Paço do Lumiar	23	5
Cidelândia	18	4
Imperatriz	18	4
Balsas	12	2
Santa Inês	12	2
Açailândia	11	2
Presidente Dutra	5	1
Others	31	6

It is reported that the highest number of infections by arboviruses DENV and CHIKV coincided between February and May of 2016, and the period with the highest number of DENV cases occurred in April 2016 with 146 (29%) cases, followed by the month of May with 98 (20%) cases. It was verified that in April and March had the highest percentage of CHIKV infections with 179 (36%) and 154 (31%) cases.

DISCUSSION

It is considered that in the last decades epidemics caused by arboviruses have been responsible for a large number of cases of mortality in the world, becoming a serious public health problem. Affecting regions of tropical climates are more affected by environmental, climatic and social conditions, with climate being an important factor in the temporal and spatial distribution of diseases transmitted by arthropod vectors, specifically DENV and CHIKV.⁹

The highest prevalence of dengue in women was found, being this result equivalent to that found in research carried out in the city of Araraquara and São José do Rio Preto.^{7,14} However, a study conducted in São Luís-MA showed a higher prevalence of reports for males, however, the variation was quite small, with a percentage of 1% differentiation.⁹ A higher prevalence of CHIKV in the female gender was identified, in agreement with a study carried out in Feira de Santana, State of Bahia, where the first case of CHIKV was identified in Brazil, the majority of which were females.¹⁵

It was noted that the higher prevalence of infections by these two arboviruses in women may be related to the longer residence time of these in their residences, because it is in the peridomestic environment where the mosquito's largest foci are found. It is known that *A. aegypti* deposits its eggs in artificial water containers, such as those used to store water for domestic use, in urban environments, preferably in the intra and the

human peridomicile, and also because women tend to seek more than men, being more likely to be notified, representing a bias in the comparisons between the rates found.¹⁶⁻⁷

It was observed that several age groups were affected, and the most affected was 21 to 40 years of age, in both arboviruses. Studies with equivalent results were observed, with the age group of 20 to 39 years being the most affected by DENV, in the period between 2008 and 2015. This age group corresponds to the economically active population, who work or study during the day.^{3,14} It was found in a study that the majority of patients infected by CHIKV were young, with a mean age of 36.6 ± 20.9.¹⁵

It is known that CHIKV can affect individuals of all ages and both sexes, however, the clinical presentation is known to vary according to age, being very young (neonatal) and advanced age the periods considered as a factor of risk for more serious diseases. It is pointed out that, in 2015, the age group with the most deaths was seventy years (median: 75), and until April 2016 the median was 62 years.¹⁸

It is observed that in the State of Maranhão, the largest number of pardos affected by the DENV and CHIKV can be explained by the predominance of the brown population and, according to the census of the Brazilian Institute of Geography and Statistics - IBGE, Maranhão is one of the The most mixed states in Brazil, with 68.8% of the brown self-declared population. It is thus reflected in the ethnicity, by the fact that the vast majority of those infected are brown, the profile of the population of Maranhão and not an ethnic predisposition for the development of arboviruses.¹⁹

It is exposed that other studies show that the ethnicity with the greatest DENV involvement in the State of Maranhão was black, with 72.7%, followed by brown, with 63.1%, and white, with 15.2%.²⁰ Interestingly, a high rate of ignored race is observed, probably because the classification of

individuals in relation to ethnicity is still considered quite subjective. Due to this difficulty, doubts arise in the professional who completes the notification forms, and the latter chooses to write down the ignored race. It is added that the lack of filling of the records in relation to the color can also be a consequence of the lack of motivation or time before the prioritization of the demands in the health services. It is understood that another explanation is that the majority of health professionals in Brazil consider filling data collection instruments as simply bureaucratic and of minimal importance.^{3,21-2}

It was verified that the majority of the patients resided in the urban zone, and these data are in agreement with the literature, since, in the State of Maranhão, 63.0% of the inhabitants live in the urban zone and 36.9% in the rural zone.²⁰ Previous studies have shown a higher incidence of dengue in urban dwellers, and these findings reinforce the fact that dengue is considered an urban disease, favored by the ecological, demographic, political, economic and cultural conditions that contribute essentially to its occurrence.²³⁻⁴

It should be emphasized in the literature that a possible underreporting should be considered, since some variables were not recorded in the data, as well as the factors that contribute to infections.⁹ A retrospective historical study of dengue in Brazil, where the regional and dynamic characteristics of dengue notifications were considered, reported that the Northeast and Southeast regions accounted for about 86% of notifications, while the South, MidWest and North were responsible for a significantly lower number.¹²

It is evidenced that studies on the evaluation of the quality of the information observed that the information systems are still flawed, showing that, on the part of the health services, an incorrect understanding as to the fulfillment of their respective documents.²³ This is a very worrying fact, since compulsory notification is a key element for triggering health surveillance actions, and only slightly more than half of the cases were reported, culminating in underreporting, masking the actual prevalence figures of these arboviruses and hindering control measures by the epidemiological surveillance system.^{11,25}

It is worth noting that, in every country, the Northeast region had the highest number of probable cases (84,051 cases, 35.2%) in relation to the total of the country in 2017, and of the 217 municipalities that comprise the State of Maranhão, 158 (73%) were

considered by the MH as high risk for dengue.²⁵ A quick survey of Infestation Indexes by *A. aegypti* indicates that 107 cities in Maranhão are at risk of dengue outbreaks, Zika and Chikungunya, and of these, 14 are at risk of an outbreak of these diseases. It is added that 93 others appear on alert and 109 are in satisfactory situation.²⁵

It is pointed out that, in Brazil, dengue has a seasonal pattern, with a higher incidence of cases in the first five months of the year, a warmer and more humid period typical of tropical climates. In a study carried out in Fortaleza (CE) on the occurrence of dengue in the period from 2001 to 2012, it was found that in April, May and June, more than 70% of the cases were confirmed, with emphasis on May 2001 (30.1%) and May 2008 (33.8%). Cases were confirmed in all months of the epidemic years, with May of 2012 concentrating more than 52% of cases confirmed that year.²¹

It is evidenced that the occurrence in the cases of DENV is related to the elevation of the pluviometric indices and to the temperature variations, mainly in the first semester of each year. This is the period of highest rainfall and temperature in most of Brazil, which contributed to the increase in the number of *A. aegypti* breeding sites.²⁶

It should be noted that, according to one study, the highest number of cases of confirmed notification was concentrated in the first half of the year surveyed, coinciding with the months with warmer weather and summer rains. This significant seasonal incidence of DENV and CHIKV in the warm months is associated with the known sensitivity of the *A. aegypti* of the reproductive cycle and temperature variations.²⁷

It is demonstrated that, in the months when there is a reduction in temperature, that is, in the second half of the year, the cases of arboviruses are reduced significantly. Even in the case of a typical seasonal disease, dengue cases are recorded both in the rainy season and in the dry season, since the reduction of the vector density of adults in the cooler and dry months is not enough to stop viral transmission.²⁶⁻⁷

It is added that the cases of CHIKV show the same seasonal behavior of the DENV epidemic, increasing in the hotter and rainier periods of the year, a fact that varies between the different regions of Brazil and other regions of the American continent. It is observed, however, contrary to what is seen in dengue, in relation to CHIKV, that, even after the epidemic period, the carriers

continue searching for health units, since this arbovirose can present chronicity.²⁷⁻⁸

It was found that the capital São Luís presented the highest number of CHIKV cases and, according to the Ministry of Health, in 2017, the Northeast presented the highest number of probable cases of CHIKV fever (141,363 cases, 76.6%), in relation to the total of the country. In the state of Maranhão, in the year 2016, 46 Maranhão municipalities with CHIKV cases were reported. The highest number of notifications were São Luís (1,253), Balsas (689), Bom Jesus das Selvas (391) and Caxias (345).²⁵

It can be observed that the municipality of São Luís has characteristics favorable to be an endemic zone of arboviruses because it has compatible climatic factors, great inadequate water stores and low population awareness about the propagation of the vector. There is also a strong propensity for the continuous recidivism of these diseases due to the existence of domestic breeding sites and social barriers that make it impossible for the health agents to work in the mosquito control, in addition to the need for government actions that are competent for a new approach to combat *A. aegypti*, as well as the lack of agility in carrying out the examinations by the competent bodies.⁹

The results of the study showed a significant drop in the number of dengue and Chikungunya cases in 2017 in relation to the number of cases reported in 2016 in the State of Maranhão. The epidemiological profile of these arboviruses in the studied period was a higher prevalence of infections in individuals from the urban zone, in the age groups of 21 to 40 years and of the female gender. It was revealed that the greatest number of dengue cases occurred in inhabitants of the municipality of Balsas, while the highest prevalence of Chikungunya occurred in the capital São Luís.

There was also evidence of underreporting of dengue and Chikungunya cases in more than half of the cases, proving the need for guidance in completing the notification forms and clarifying health professionals about the importance of information for epidemiological surveillance effective.

The situation of arboviruses in Brazil has been a constant concern for health authorities, and this reality has not been different in the State of Maranhão, because it is an endemic region of dengue and Chikungunya and presents favorable climatic factors for the proliferation of the mosquito vector and the consequent dissemination of these arboviruses. It is also mentioned that

despite the problem of underreporting, the number of cases reported in recent years has been quite significant.

In this way, we can see that the epidemiological situation of the state of Maranhão continues to be a worrying public health problem, requiring a greater increase in the control and control of vector outbreaks, as well as the improvement of health education programs to sensitize the population for the effective eradication of domestic mosquito breeding sites.

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